

ON A SURVEY OF THE GANGES RIVER DOLPHIN *PLATANISTA GANGETICA* OF BRAHMAPUTRA RIVER, ASSAM¹

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(With a plate and five text-figures)

Key words: Ganges river dolphin, *Platanista gangetica*, Brahmaputra, population estimate, mortality, ecology, behaviour, depletion of population, recommendations.

Population of Ganges river dolphin, *Platanista gangetica* in the river Brahmaputra from South Salmara to Sadiya is estimated to be 400. Annual mortality is about 60. The river was divided into 6 sectors and the population of dolphins in each sector was studied. Size range, distribution in relation to depth and distance from the bank, fishing activities, relation between dolphins and river terns, behaviour, resident populations and depletion of fish stock were studied.

INTRODUCTION

The Ganges river dolphin, *Platanista gangetica* is distributed in the rivers — Ganges, Brahmaputra and Meghna river systems. It is known as 'susu' in Hindi and 'shihu' in Assamese. Anderson (1878) published a detailed observation of its biology, anatomy, behaviour and ecology. About a hundred years after his work, Pilleri (1970, 1980), a Swiss scientist made a detailed study on its embryology, sonar mechanism and ecology. He could capture a few specimens from Brahmaputra. Kasuya (1972) transported four dolphins to Japan and made observations on its behaviour. Kasuya and Haque (1972) conducted a study of the population of the river dolphin, *P. gangetica* of Bangladesh rivers and estimated its population to be about 770. Jones (1982); Mohan (1989, 1992, 1994a,b, 1995); Mohan *et al.* (1993); Gupta (1986); Rao *et al.* (1989); Shrestha (1989); Reeves and Brownell (1989); Reeves *et al.* (1993); Sinha (1991, 1992); Hussain *et al.* (1993); Smith *et al.* (1994, 1995) and, Reeves and Leatherwood (1995) studied various aspects of the Ganges river dolphins of India and Nepal.

Gupta (op. cit.) counted 59 dolphins in the Ganges and its tributaries. Mohan (op. cit.) observed 21 dolphins in the Ganges from Kanpur to Farakka barrage and estimated its population to be about 600 in the Ganges. Sinha (op. cit.) recorded 217 and 109 Ganges river dolphins in 1992 and 1993 respectively between Buxar and Farakka barrage at the confluences of various tributaries of the Ganges. Rao *et al.* (op. cit.) studied the population of river dolphins of Chambal river and estimated the number as 40. But our information on the Ganges river dolphins of Brahmaputra is far from satisfactory. Hence this study was undertaken.

MATERIAL AND METHODS

The survey of the tributaries of the river was conducted from October 1992 to June 1993⁴. The larger tributaries like Teesta, Manas, Subansiri, Dihang, Dibong (upto Boling) Luit (upto Teju) on the northern bank and Jingiram, Kulsi, Kalong, Dhansiri, Disang, Dihing, Noa-Dihing on the southern bank were surveyed.

The main stream of the river was surveyed from 15th February to 18th March, 1993. The

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⁴However, the authors were visiting the resident populations for the last four years.

river was divided into the following 6 sectors, each covering about 100 km (Fig. 1)

Sector 1 South Salmara to Goalpara

“ 2 Goalpara to Guwahati

“ 3 Guwahati to Tezpur

“ 4 Tezpur to Dholpur

“ 5 Dholpur to Buridihingmukh

“ 6 Buridihingmukh to Sadiya.

Both the south and north banks of the main stream were studied. Apart from the population estimate, physical parameters such as temperature, transparency, depth and fisheries of the river were also observed.

A 30 ft (9 m) boat fitted with an 8-HP outboard engine was used for the survey. Observations were made by the investigators seated on the deck with binoculars, and camera fitted with 200 mm zoom lens. Whenever dolphins were sighted, the site of surfacing was approached and the following data were collected:

1. Depth of water
2. Distance from shore
3. Fishing activities
4. Surfacing time
5. Length of the dolphins

Dolphins measuring below 1 m were considered as calves, 1 to 1.75 m as adolescents and more than 1.75 m as adults. No attempt was made to segregate males and females in the field, though the adult females can be distinguished by their longer curved beaks. Precautions were taken not to recount or miss the dolphins. When the dolphins were sighted, their number was determined by the following criteria:

1. Number of dolphins surfacing simultaneously.
2. Number of dolphins surfacing within an interval of 5 sec at a distance of more than 10-20 m from each other.
3. Size of the dolphins.

The boat stayed at the site of surfacing for at least 30-40 minutes for counting the numbers. At least 3 counts were taken by each investigator on a well defined proforma. The number of dolphins in the area was determined after

scrutinising the data from all the investigators. As most of the sightings were recorded from the confluences of the tributaries, more attention was paid whenever river mouths were reached. The river tern, *Sterna aurantia* was found in association with the dolphins and it was considered as an indicator species. Invariably, the river dolphins were observed in their neighbourhood.

Number and types of fishing nets and their catches were also observed. Upstream journey was taken along the southern bank, while the northern side was covered during the return journey. It was not possible to follow a direct path as sand bars blocked the navigation route and the boat often got grounded, imposing great hardship on the observers. It was difficult to extricate the boat from the sand bar. The boatmen were good navigators and they could cruise the boat very carefully through the deeper parts where there was just sufficient water to keep the boat afloat.

As the study was undertaken during the dry season, (March-April) the tributaries were dry and most of the dolphins had come to the main stream and were found in deeper waters.

A 12-hour schedule was followed from 0600 hours to 1800 hours without any break. Nights were spent in the boat anchored near the 'chars' or the river islands guarded by the stengun wielding security personnel of the Assam Police. The upstream journey took 13 days while downstream was covered in 9 days.¹

OBSERVATIONS

¹Considering the width of the Brahmaputra, the area to be covered, and the extent to which visual observations are possible, there are great constraints in the survey to make it truly quantitative.

The Brahmaputra cannot be surveyed in all months due to strong currents and cyclonic winds. Photo-identification, mark recovery and telemetric studies are not possible for these animals owing to their behaviour; they can neither be caught nor tamed. Methods used for terrestrial animals and the marine dolphins and whales cannot, therefore, be used for river dolphins.

The survey thus brings out only an indicative picture and cannot project a hundred per cent enumeration, which, under the circumstances, is near impossible.

Physical features: Transparency of the river was observed with the help of a Sechi disc. Three observations were taken at 10 km intervals and mean values of each station were recorded. In the first 100 km downstream, transparency was 20 cm. It was 40 cm, 45 cm, 48 cm, 57 cm and 65 cm in sectors 2, 3, 4, 5 and 6 respectively.

Water temperature was taken at 50 cm depth at intervals of 10 km during the daytime, and varied from 15°C-28°C. In the lower reaches, the temperature ranged from 23°C-28°C in sectors 1 to 4. Temperature varied from 18°C-23°C in the 4th and 5th sector. It dropped to 15°C-17°C in the 6th sector.

1. **Dolphin Population:** During the cruise from South Salmara to Sadiya, 266 dolphins were observed. The population density was analysed for each 100 km sector of the river, covering a distance of 650 km (Fig. 1). The maximum number — 58 dolphins were observed in the 3rd sector from Guwahati to Tezpur. The lowest number of 23 dolphins were observed in the last sector between Tengapani (Burhidihingmukh) and Sadiya. Water level was very shallow in this sector during the time of observation, and we could observe vast exposed areas. Population of dolphins in the first 300 km stretch was 53/100 km whereas it was only 35/100 km in the upper 300 km sector. The average number of dolphins observed per 100 km was 44 only, i.e. 0.44/km.

In the first sector from South Salmara to Goalpara, 47 dolphins were observed. The rivers Jingiram, Gangadhar, Gadaghar, Sankosh, Jinari, Moramanas and Manas become confluent with the main stream in this region. The second sector from Goalpara to Guwahati had a population of 54 dolphins. The rivers Krishnai, Singri, Dudhani, Puthimari, Kulsi and Pagaldia are in this sector. In the 3rd sector from Guwahati to Tezpur, 58 dolphins were observed. The confluence of Kalong river had a herd of dolphins. The tributaries Mangaldai, Rangapani, Dhansiri Panchnai, Belsiri, Jiagabharu, Kalong and Digru flow through this sector. The 4th sector extended from Tezpur to Dholpur. In this sector

we observed only 34 dolphins. The tributaries Bharali, Baraganga, Burai, Salang from the northern bank and Diphlu and Dhansiri from the south bank meet the main stream. The 5th sector was from Dholpur to Burhidihingmukh. 45 dolphins were observed here. In this sector many large tributaries are present. Important among them are the Dikrang, Subansiri, Kakadonga, Dikho, Disang and the Burhidihing. The last sector from Burhidihingmukh to Sadiya had only 28 dolphins. The main tributaries in the sector are the Dibru, Noa-dihing from the south bank and Simen, Dibong and Dihang from the north bank (Fig. 2).

About 60% of the dolphins were found along the north bank from South Salmara to Guwahati, while from Guwahati to Sadiya 42% were along the north bank, 56% along the south bank and 2% dispersed in the main stream. Taking all the factors and the extent of the river into consideration, the total population in the river may not be more than 400 from south Salmara to Sadiya.

2. **Size range:** The size group of dolphins was studied based on their length. As it was not possible to measure the dolphin by conventional methods because the studies were made 'in situ', they were classified into calves, adolescents and adults based on its length upto 1m, 1-1.75 m and 1.75 m and above respectively.

It was observed that 57% were adults, 30% adolescents and 13% calves (Fig. 3). When the data was analysed sectorwise, it was found that the adults formed 75%, followed by 17% adolescents and 8% calves in the first sector; 59% adults, 37% adolescents and 4% calves in the second sector; 60 adults, 22% adolescents and 18% calves in the third sector; 45% adults, 40% adolescents and 15% calves in the fourth sector; 51% adults, 38% adolescents and 11% calves in the fifth sector; 54% adults, 25% adolescents and 21% calves in the sixth sector. It may be mentioned that adults were predominant in almost all sectors (Fig. 4). Only in the 6th sector were the calves more than 20%. Distribution of

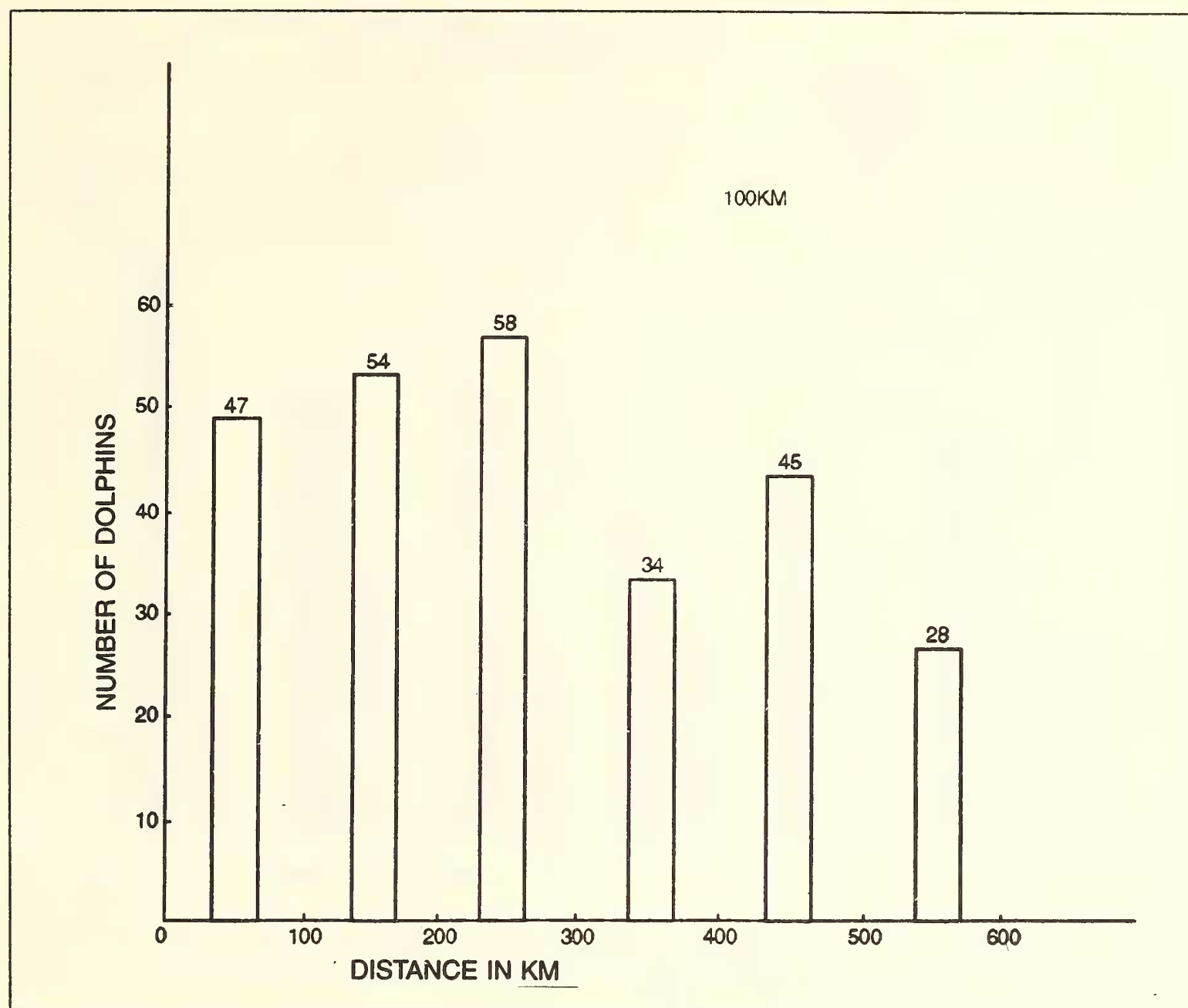


Fig. 2. Number of Ganges river dolphins observed in the River Brahmaputra

adults did not present a uniform trend. They were found in greater numbers in the first 100 km sector. Adolescents were found in greater numbers in the second sector, while more calves were found in the fourth sector.

3. Distribution of river dolphins in relation to depth: 40% of the dolphins were observed in 3.0 to 4.9 m depth and 27% were found in 7.0 to 8.9 m depth. Only 12% were found in the shallow waters of 1.0 to 2.9 m. Deeper water of 5 to 6.9 m harboured 18%, and only 3% were found in 9 to 15.9 m or more. The data was analysed in relation to the distribution of calves, adolescents and adults. The favoured depths for adults and adolescents were 3.0 to 4.9 m whereas

calves were found in greater numbers in 7.0 to 8.9 m, indicating their preference for deeper waters. This observation was supported by the occurrence of calves of the dolphin in Khahalgong in Ganges, where the calves were observed in 25-30 m deep waters.

4. Occurrence of dolphins in relation to distance from the bank: 66% of the river dolphins were found 1 km from the bank, 22% from 1 to 2 km and only 12% were found beyond 3 km from the bank. The size groups were also analysed to find whether there was any preference to distance from the bank. Here again, the adults, adolescents, and calves showed preference to near-bank areas.

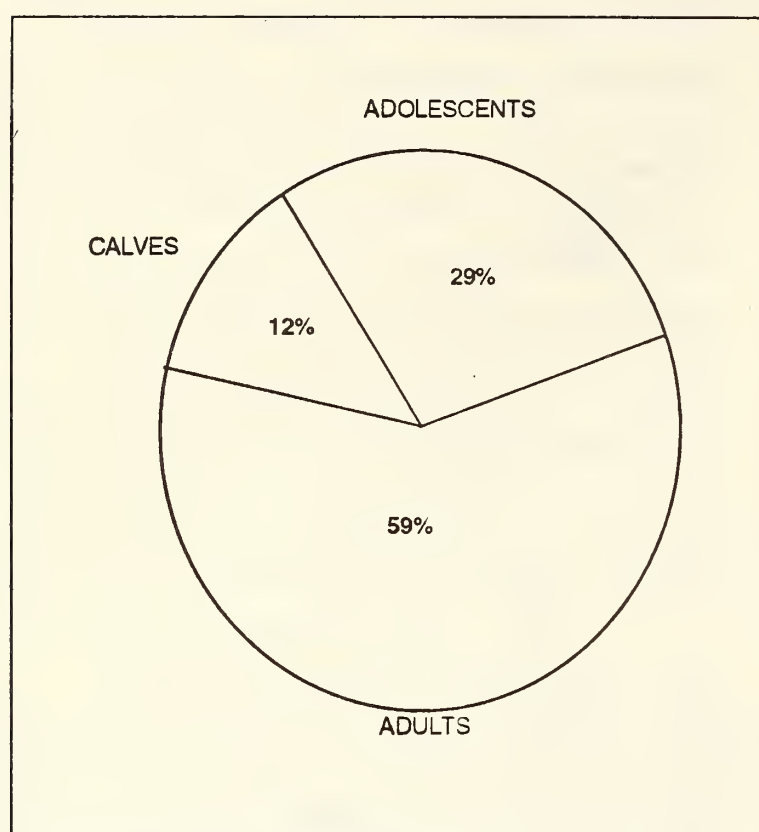


Fig. 3. Percentage of adults, adolescents and calves of Ganges river dolphins in the River Brahmaputra

5. Occurrence of dolphins in relation to fishing activities: The river dolphins were found in larger numbers where there was fishing activity, which in turn, depended on the concentration of fishes in an area. In one instance, fishermen were seen splashing the surface water with oars to chase away dolphins taking away fishes from the net. Dolphins were also found in the vicinity of human activities like bathing ghats and washing ghats. They were seen surfacing 5 to 10 m away from where children were bathing. Young dolphins were found close to human activities.

6. River tern as an indicator species: The river tern (*Sterna aurantia*) was associated with the river dolphin. Very often dolphins could be located with the help of river terns. The terns fly over the surfacing dolphins and catch fishes that jump due to the disturbance caused by the dolphins. In a few instances, the terns were found to snatch fish from the beaks of the dolphins. Of the total number of terns observed, 26% were associated with river dolphins. On one occasion, about 31 terns were noticed, however, they were

usually found alone. But flocks of 10-13 were observed at the confluences of the river Kalong. The terns were found feeding on fishes. 16 river terns were observed along with the river dolphins at the confluences of the Subansiri river. Birds were found hovering over the dolphins. Dolphins were observed at a distance of about 1-15m from the terns, indicating their close relationship.

7. Behaviour: The river dolphins were found alone in pairs or in units of 3 comprising an adult male, a female and a calf. A school of 10 dolphins was observed at the confluence of Kalong river, and 15 dolphins were found at the confluence of Subansiri. Large dolphins more than 2.4 m long were solitary.

Various modes of surfacing were observed. The most common was the appearance of the beak followed by the melon and the anterior part of the body. This mode of surfacing was common when the animal was not feeding. In another mode, the beak was exposed at 30° to 45° followed by the body. Here the body was more exposed. Adult dolphins surfaced in this way. Very often, dolphins surfaced while projecting the melon to breathe. In this mode of surfacing, the body was hardly exposed. While feeding, dolphins were observed to chase the fishes, vigorously splashing their caudal flukes. The calves and adolescents were seen leaping over the surface of the water, exposing their entire body. This behaviour was usually seen in the late afternoon. An adult dolphin was once seen to leap over the surface in the Mihi bheel of Kaziranga National Park. The 'leaping' was found to be more frequent in calves, especially between 1430 and 1600 hrs.

8. Surfacing Interval: Interval of surfacing ranged from 10 sec. to 90 sec. The calves surfaced more often than the adults. But surfacing time was highly variable. Various factors such as depth of the river, current flow, food availability, and other factors like fishing activities and human disturbances influenced the surfacing of the dolphins.

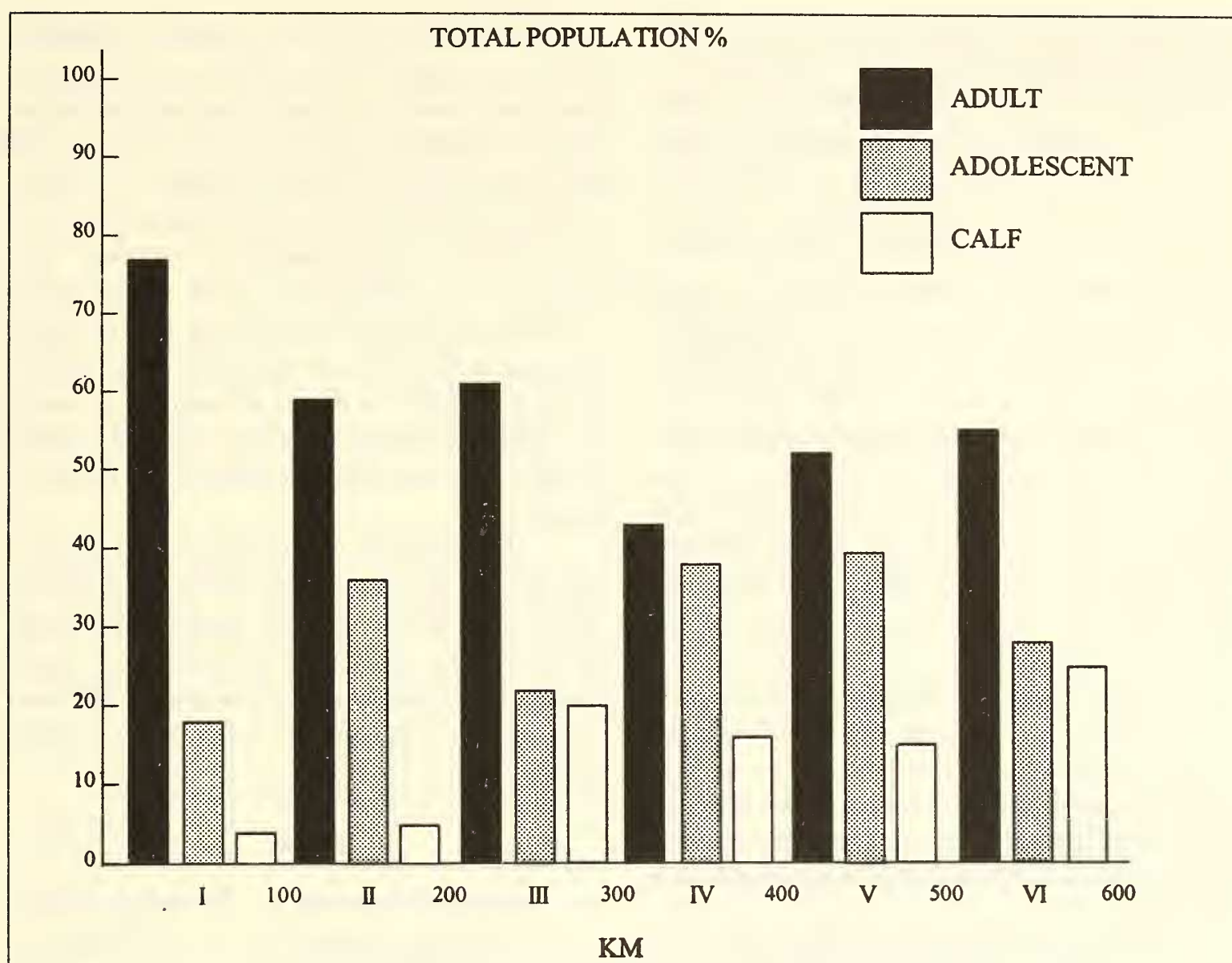


Fig. 4. Distribution of Ganges river dolphins in each sector of the River Brahmaputra

The breath of the dolphins had a foul smell, which was more keen on windless days in small rivers like Kulsi. The smell was similar to the breath of cows. It was pungent in bigger dolphins.

9. Resident populations: When the river dolphins were found throughout the year in a river without migrating back into the main stream during the dry months, they were considered as a resident population. Such populations were found in Kulsi river, Subansiri river and in Mihi bheel. Historically, many tributaries of Brahmaputra harboured resident populations of dolphins. But due to human disturbance such as fishing, sand extraction and pollution, such populations were not found in the tributaries. In Bhagdoi river, a river dolphin

population was found in the 1960s when Dr. Pilleri visited the area. He captured six dolphins from there in his attempt to transport them to Switzerland. But all of them died. When the senior author visited the river in 1993, no dolphins were found in the river and the river was silted and almost dry with less than 30 cm of water.

a) Kulsi river dolphin population:

Kulsi river is located at $92^{\circ} 30' - 93^{\circ} 31' E$ and $26^{\circ} 0' - 26^{\circ} 10' W$. It is one of the southern tributaries of Brahmaputra. River dolphins were found near the village Kukurma which is about 35 km from Guwahati. The river originates from the Meghalaya hills and meanders through a distance of about 120 km before meeting the main stream near Nagarbera. About 25 dolphins were

found in the river sector of about 2 km in 1993. They were found in two areas adjacent to the deeper parts of the river. One sector was found north of the road bridge and the other on its south. The population consisted of 64.3% adults, 25% adolescents and 9% calves. But the river was degraded due to sand extraction. About 100 lorry loads of sand were extracted daily for at least 250 days in a year. The removal of the sand has its ill effects like increase in turbidity, soil erosion along the banks, reduction in the productivity and silt formation in the downstream areas. There was over-exploitation of fishery resources also. For our study, the Kulsi river was divided into 9 sectors, each covering about a kilometre. Dolphins took refuge in deeper areas during the lean period, foraging in the adjacent areas where there was an abundance of fish. Mohan (1996) has reported 61 species of fishes and 4 species of prawns from the Kulsi river. But with the change in the morphology of the river due to sand extraction, the habitat of dolphins was seriously affected. Dolphins were not harmed by the local people as they feel that killing them would invite bad luck.

b) Resident population of Subansiri river:

Subansiri is one of the fast, turbulent northern tributaries of the Brahmaputra bordering the northern bank of the Majuli Island. It originates from Tibet, having an annual discharge of more than 20 million cusecs. The area between Subansirimukh and Dikrangmukh had a population of about 25 river dolphins. During the 1950 earthquake which caused large scale land slides and seismic explosion, large numbers of dolphins died in the river. The river bed also had aggraded to about a metre, causing severe flood during the rainy season. Here dolphins were killed by the 'Mising' tribes for their meat. They were often brought to the Jingramukh fish market.

c) Resident population of 'Mihi bheel' of Kaziranga National Park:

Mihi bheel was located inside the Kaziranga National Park. The 'bheel' was about

5 sq. km in area, fringed by wetland vegetation and water plants. The middle portion of the bheel was about 6 m deep. The marginal areas were so shallow that one-horned rhinoceros and swamp deer were seen wading. As it was located in the protected area, the bheel was very rich in fish. Large numbers of 'chital' fish (*Notopterus chitala*) were seen in the bheel 'surfacing', especially during the evening resembling that of river dolphins. Nearly three hours were spent in the river rowing in a small, 5 m dinghy covering the entire bheel. We could observe only one large dolphin of about 2.4 m length.

10. Mortality of dolphins: It was estimated that in 1993-1994 about 60 dolphins were killed accidentally or intentionally in the Brahmaputra. Enquiries revealed that many were killed from Malka Char (South Salmara) to Goalpara followed by Jorhat to Dibrugarh (Table 1).

TABLE 1

Malkachar to Goalpara	15
Goalpara to Guwahati	5
Guwahati to Tezpur	5
Tezpur to Jorhat	10
Jorhat to Dibrugarh	12
Dibrugarh to Sadiya	10
Total	57

The dolphins were killed mainly for their meat and oil. 'Mising' tribals relish dolphin meat, while in the lower reaches from Malkachar to Goalpara it was mainly killed for its oil which was used for the preparation of bait for the catfish *Clupisoma garua* (Mohan and Kunhi, 1992). The oil is used for the preparation of medicines for rheumatism and also for pain in the joints.

A mortality curve (Fig. 5) highlights the impact of mortality on the river dolphin population.

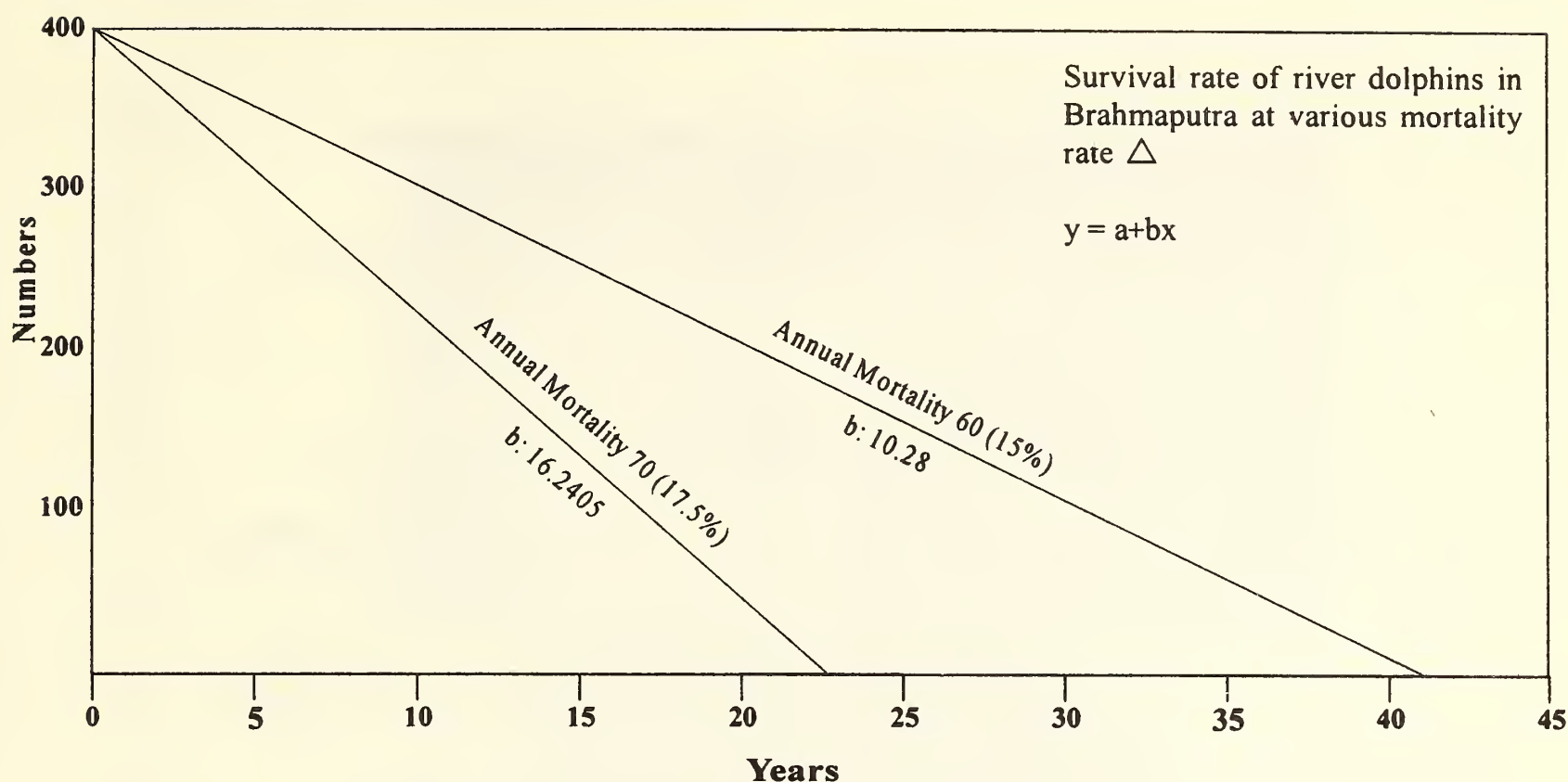


Fig. 5. Mortality curve of river dolphin population of the River Brahmaputra for the year 1993

The following data was used for the calculation:

Total population (estimated)	: 400
Calves	: 48 (12%) (Recruitment)
Adults	: 236
Adolescents	: 116

Though the actual number observed in the main stream was 266, due to the river span which is about 8 km in some areas, there was a possibility of missing some of them in each sector. Hence it was estimated that there may be 400 dolphins in the river from South Salmara to Sadiya.

Status of its population with a mortality of 60 and 70 numbers annually was calculated using the formula:

$y = a + bx$, where x is the years and y the number

It was observed that if the mortality was 60 numbers, the population would last for 38.5 yrs, and if the mortality is 70 numbers annually, the population will last only for 23.7 yrs.

11. Major threats to the dolphin population in Brahmaputra: The major threats faced by the river dolphins of Brahmaputra are habitat loss, gill nets, poaching and fish stock depletion.

The Brahmaputra and its tributaries are highly silted and most of the tributaries run dry during summer. Though Brahmaputra is a mighty river with a drainage basin of 2,20,057 sq. km and receives about 60 tributaries it becomes shallow and not navigable during summer.

The severe earthquake of 1950 had elevated or aggraded the river bed, and caused extensive landslides in the northeastern hills and in the river Subansiri. Huge fissures had developed through which sand and silt soaked with water were ejected in many places. The river water was laden with heavy minerals which rendered it black. The sulphur content of the water was so high that it was declared unfit for consumption. The extraordinary shock of the earthquake with the seismic explosion had caused heavy mortality of fishes and dolphins. The river Brahmaputra had changed its course

near Dibrugarh. Even today, some eyewitnesses testify to the drifting of large numbers of fishes and river dolphins in the river after the earthquake. Unfortunately there is no official or scientific data on the fishes or the number of dolphins killed in the earthquake.

a) Gill nets:

Gill nets of various mesh sizes are operated in the river. The large gill nets with mesh size of 8-12 cm having a depth of about 3 m and length 50-100 m are called 'fasi jals'. They are dangerous to the dolphins as they get entangled in them. These nets are in greater numbers in Dibrugarh, Neematighat, Silghat, Tezpur, Guwahati, Goalpara and Dhubri. About 20 'fasi jals' were operated south Salmara and Goalpara, 30 between Goalpara and Guwahati, 15 from Guwahati to Tezpur and about 40 between Tezpur and Dibrugarh (Table 2.) The dolphins get entangled in the nets when they try to feed on the fish caught in the nets. It has been observed that the fishermen splash the surface of the water with oars to scare away the dolphins.

b) Poaching:

River dolphins were killed by harpoons. One two or three pronged harpoons were used (Plate 1, Fig. 1). A harpoon unit consists of a wooden pole and a harpoon attached to a strong rope. A harpoon is fitted tightly to the pole. Fishermen throw the harpoon on the dolphin from the boat when the dolphins surface. The harpoon plunges deep into the flesh of the dolphin and gets released from the pole. The exhausted dolphin is then dragged to the boat and killed. Deep wounds were seen in the harpooned dolphins (Plate 1, Figs. 1 & 2). Nearly 20-25 dolphins are killed by harpoons annually. 'Bin' fishermen of Bihari origin, Bangladeshi fishermen from lower Assam and the 'Mising' tribes of upper Assam are experts in using the harpoons. The 'Mising' tribals consume the meat whereas the Bihari fishermen and Bangladeshi fishermen use the flesh and blubber to extract oil for the preparation of fish bait.

c) Depletion of fish stock:

TABLE 2

Types of Nets		No. of Nets
Native Names	English Names	
Fasi jal	Gill nets	113
Dheki jal	Lift nets	83
Boralia jal	Khatai jal with pockets	102
Asra jal	Cast net	1000
Shangla jal	Clap net	2500
Thela jal	Scoop net	1500
Kapda jal	—	120
Tanalagi jal	Pocket nets	120
Rosor Uta jal	Gill net with 2 ropes	50
Current jal	Drift net with monofilament webbing	120
Beng jal	Triangular net supported by bamboo frame	500
Bor jal or Maha jal	Large Drag seine net	60
Othal jal	Cast net variant, operated from a boat by 2-3 persons	100
Paa jal	'X' shaped net operated from a boat	100
Khora jal & Tongi jal	Rectangular nets	200
Poloh, Sepa, Jalko		
Poloya	Traps	5000
Kanta	Hooks and line	1000's

In recent years the fish catch in Brahmaputra has declined to a great extent (Yadava and Chandra 1994). There was a steep increase in the number of crafts and gear including the harmful net 'Kapda' jal made of mosquito webbing (Plate 1, Fig. 3). This net was used extensively from Dhubri to Sadiya though it was banned by the State Government. These nets removed the fry and fingerlings of almost all the species including the major carps. The small fishes *Aspidoparia morar*, *A. jaya*, and *Chela atpar* were also caught in the net.

Table 2 indicates the number of nets observed during the cruise.

Further the 'Mohildhar system' of leasing out the riverine areas to individuals based on auction has caused great harm to the fish resources, as the lessees are interested only in exploitation without any concern for conservation or augmentation of the fishery resources. Though the lessees sign an agreement that they will stock the rivers with spawn and fry, it is not followed in practice.



Fig. 1. River dolphin *Platanista gangetica* with harpoon;
Fig. 2. Harpooned Ganges river dolphin, Note the harpoon marks;
Fig. 3. The banned 'kapda jal' made of mosquito webbing used extensively in the river Brahmaputra.

DISCUSSION

All the species of river dolphins are threatened all over the world due to various human activities. Habitat degradation, navigation and fishing activities have driven the river dolphins of the Yangtze river, (*Lipotes vexillifer*) to near extinction. Though the status of the Ganges river dolphin may not be as bad as *L. vexillifer*, its mortality rate causes serious concern.

The total population of the Ganges river dolphins in the river Brahmaputra can be assumed to be about 400. If the population is dissected the adults will be about 236 (59%), adolescents 116 (29%) and the calves 48 (12%). If we consider the sex ratio as 1:1, the breeding population (females) will be about 118 (50% of the adult population). Though we have no information on the potential breeders of the population, it may be about 70% as has been calculated for other dolphins. In that case the number of potential breeders may be about 82. As they calve in alternate years, (Brownell 1984) the recruitment per year will be 41 or 10.25% of the population. It was observed that the mortality in gill nets and poaching ranged from 12.5% to 15%, which was too high to maintain a sustainable population.

Various methods were suggested for the survey of the dolphins in the river systems (Smith *et al.*, 1995). But it will not be possible to follow a uniform method in all the rivers as the topography and the morphology of the rivers are not the same. In the present study, the direct method was followed, as the width of the river is about 8 km in some places.

Kasuya and Haque (1972) found that 90% of the dolphins sighted were solitary individuals. They do not mention any gregarious schools. In the present study also, 70% were solitary individuals, 20% in pairs, 8% in threes and 2% in a school of more than 10 dolphins. Such schools were observed at the confluences of the tributaries with fast current. Such schooling

behaviour may be attributed to the availability of food and not to any gregarious behaviour.

It had been observed in the marine dolphin *Cephalorhynchus commersoni* (Commerson's dolphin) that they got entangled in the nets not because they did not detect the fishing nets but because they did not always use their sonar mechanism or when they tried to feed on the fishes caught in the nets (Evans *et al.*, 1988). Many investigations have been made on the interaction of dolphins and gill nets and ways and means suggested to reduce dolphin mortality in gill nets (Dawson 1994, and Goodson *et al.* 1994). But no satisfactory device has been made so far to reduce the gill net entanglement.

Very little information is available on the lactating Ganges dolphin (Brownell 1984). According to a fisherman at Dihingmukh (upper Assam), a dolphin of length 2.3 m got entangled in a gill net. When it was transferred to the boat the milk got squeezed from the mammary glands and spilt in the boat. Two days after the incident, a calf was caught from the same vicinity. The dolphin was caught in April before the onset of monsoon.

Study of the fishery of the river is essential as fish constitute the major food item of river dolphins (Anderson 1879, Shrestha 1989, and Sinha 1992). From Assam, 129 species of fish were reported by Yadava and Chandra (op. cit.) and 119 species by Mohan and Rema Devi (1997). During the cruise, about 80 species of fish were collected from the main stream and 40 species were obtained from Kulsi river. Due to various human activities the fish production of the river has come down in recent years and Assam gets most of its requirement of fish from other states. Little detailed monitoring of the fish production is carried out. The catch statistics are available only from Guwahati and Jorhat (CIFRI, 1989-1990). In 1989-90 the total fish landings in both the centres were 247 tons and 36.4 tons respectively. Fish catch should be monitored at least from Dhubri, Goalpara,